Measuring real bank output

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Measuring real bank output: considerations and comparisons

The real output of banks is better estimated by counting the number of service transactions they provide than by using the balances of loans and deposits deflated by a price index

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The recent financial crisis highlights the critical role of financial intermediaries, including commercial banks, in maintaining the health of the real economy. It is important, therefore, to measure the real output of banks accurately. However, the measurement of real bank output has proven difficult. Much of the difficulty stems from the fact that banks do not charge explicit fees for many of their services. Moreover, the banking industry has undergone major transformations over the last few decades in terms of its production technology, regulatory environment, organizational structure, and range of product offerings. These changes further complicate the measurement problem. This article applies a coherent framework in order to evaluate and compare the two main approaches used in official statistics which measure real bank output that is not explicitly charged for. It then suggests areas for further improvements.

Measuring the constant-price output of service-providing industries is generally more challenging than measuring the constant-price output of goods-producing industries[1] because the intangibility and heterogeneity of many services make it harder to measure constant-quality output over time. In addition, it is more difficult to measure the nominal value of the output of commercial banks than that of other services industries because banks do not charge explicit fees for many of the services they provide. Most services associated with underwriting loans and taking deposits are instead implicitly paid for through higher interest rates charged on loans and lower interest rates paid on deposits. This means no explicit price is observed for these bank services, so the standard statistical procedure of surveying prices in order to decompose revenue into price and quantity cannot be implemented for banks.

Faced with this challenge, statistical agencies have tended to choose one of two approaches. The first approach, adopted by the U.S. Bureau of Labor Statistics (BLS) almost three decades ago, is to count the number of loan and deposit transactions.[2] The other approach is to use the balances of loans and deposits deflated by a broad price index; this is the dominant method used across Europe.[3] Both approaches directly measure quantity indicators, so the corresponding price indexes are implied from the given (imputed) revenue. However, the two approaches differ in their underlying theoretical assumptions. The resulting output series also exhibit noticeably different growth patterns, so the methodological choice is of first-order importance.

In this article we argue, primarily from a conceptual point of view, in favor of the counts-based approach. We then compare the empirical estimates derived from the two different approaches. We conclude with discussions of some continuing challenges to improving the counts-based measures.[4]

Output of banks: counts or deflated balances?

In principle, one should choose an output measure that corresponds best to the conceptual definition of the services provided by

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banks to their customers. The literature on financial intermediation has argued that, at their core, banks serve to mitigate information and transaction costs.[5] For borrowers, banks evaluate the creditworthiness of loan applicants and, after loans are granted, banks monitor the behavior of the borrowers. For depositors, banks provide a range of transaction services—ATM withdrawals, fund transfers, purchases with credit and debit cards, etc.

Note that these bank services may or may not be associated with loan or deposit balances held by the bank providing the services. The measure of output should be invariant to the balance-sheet status of the associated financial products. For instance, it is common nowadays for banks to sell mortgage loans after origination to legally independent entities that then pool and package the loans into asset-backed securities, but the banks continue to service the loans for a fee. This kind of separation between holding assets and providing service is, in fact, a prominent theme of many of the financial innovations of recent decades. But as long as the services provided are the same before and after the change in institutions, the output measure should also be invariant to such changes.

Viewing banks as providers of information and transaction services is thus consistent with the financial intermediation literature and robust to today's changing business models. The goal is then to measure the information and transaction services provided by banks.[6] If we use the number of loans and the number of deposit transactions as the quantity indicator of bank service output, we essentially assume that each loan or each deposit transaction represents a constant quantity of services. By comparison, using the (deflated) loan and deposit balances assumes that each (real) dollar of loans or deposits represents a constant quantity of services.

For the number of loans to be a measurement of a constant quantity of lending services, the loan categories must be carefully defined. For instance, a business loan to provide working capital requires a different level of services (and likely generates a different amount of utility for the borrower) than a residential mortgage, so they should be classified into separate categories. Likewise, a conforming residential mortgage typically requires a different amount of work—probably less—to originate than a jumbo mortgage, so ideally we should distinguish between them as well. The same logic applies to depositor services—the specific services should be carefully distinguished. Once we have derived the output of each category of borrower and depositor services, we can calculate the aggregate bank output as a Törnqvist index using revenue weights. This is analogous to the general approach used in official statistics for other industries that produce more than one product.

A special complication for the banking industry is that revenue has to be imputed for those services that are not explicitly charged for. The imputation is based on the so-called user–cost approach. Imputed revenue equals the asset balance multiplied by the gap between the actual interest rate charged or paid by the bank and the rate on the reference market security with the most comparable risk characteristics and no attached services.[7] In the next section, we discuss in some detail how to estimate the implicit revenue of bank lending services in the context of commercial and industrial loans.

In comparing the counts-based approach and the deflated-balances approach, we would argue that it is more plausible that the quantity of bank services is proportional to the number of loans and deposit transactions than to the deflated balance of loans and deposit accounts. In practice, we would advocate using the former as well, given the existence of count data on loans and deposit transactions. Consider the following stylized example. In year 1, borrower A obtains a mortgage of $85,000 to buy a house for $100,000. In year 2, borrower B, who has the same creditworthiness as borrower A, obtains a mortgage of $93,500 to buy the same house for $110,000. These two loans, therefore, have the same loan-to-value ratio. From year 1 to year 2, the general price level has not changed, so according to the deflated-balances approach, real mortgage services have increased by 10 percent. According to the counts-based approach, however, real mortgage services are unchanged because the two loans are identical in terms of the risk evaluation performed during origination.[8] The only change from year 1 to year 2 is an increase in the price of the house, which is irrelevant to the amount of origination services performed.

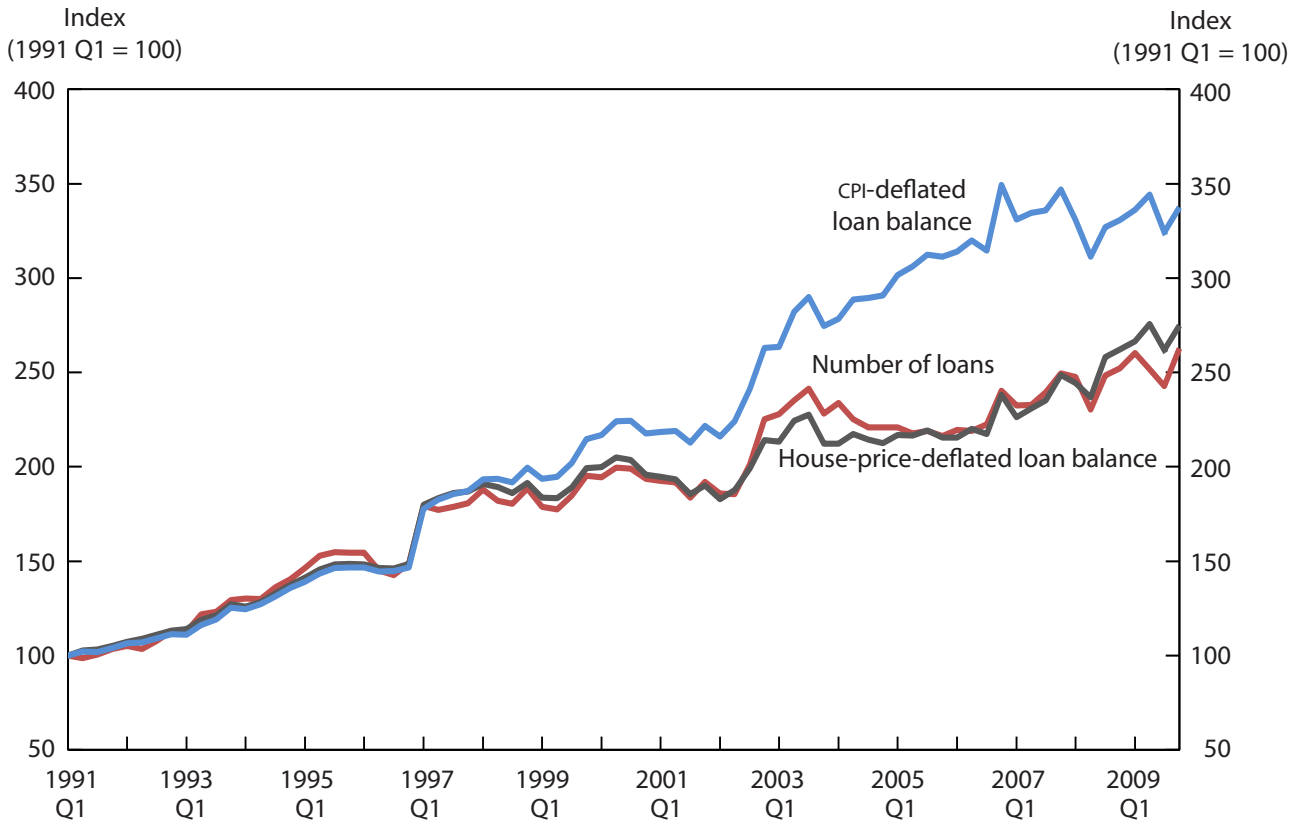
This example also suggests that the deflated-balances approach can generate a decent proxy for the number of loans under the conditions that we have a good price index for the underlying assets being financed and that the loan-to-value ratio is constant over time, as is assumed in this example. Then we can use the loan balance deflated by the asset price index as our output measure. In practice, the loan-to-value ratio for residential mortgage loans is not constant, but reasonably stable in the United States. The monthly interest rate survey of the Federal Housing Finance Agency shows that, between 1963 and 2010, the loan-to-value ratio has fluctuated, staying within a range of 71 percent to 80 percent. This is a fairly narrow range compared with the growth of (nominal) real estate loan balances held by banks, which have increased by a factor of 90 over the same period.

When we apply this method of deflating the loan balance with the relevant asset price for mortgage loans, we indeed find that the output index based on the number of mortgage loans closely tracks the index based on the loan balance deflated by a house price index compiled by the Federal Housing Finance Agency. Chart 1 depicts these two output indexes, along with an index based on the loan balance deflated by the Consumer Price Index (CPI, specifically, the CPI for All Urban Consumers, CPI-U). We see that the CPI-deflated balance index shows much faster growth than either of the other two series from the late 1990s until the onset of the financial crisis in late 2007, coinciding with the period when house price appreciation far outpaced general inflation.

In short, the deflated-balances approach can yield a reasonable proxy measure of bank lending output for those loan categories where it is clear what assets—for which there are reliable price indexes—serve as the underlying collateral. Under the assumption that the average loan size follows the same trend as the average price of the collateral, loan balances deflated with the collateral price are a valid proxy for the number of loans. In addition to working for residential mortgages, this approach could also work well for car loans.

However, the deflated-balances approach is much less likely to generate a good proxy for the number of consumer loans or commercial and industrial (C&I) loans because there is a paucity of data on the goods or services financed by these loans. For instance, using data from the Federal Reserve's Survey of Terms of Business Lending (STBL), we estimate that the average size of C&I loans has *decreased* by 37 percent between 1997 and 2009. This is likely the result of technological advances that make it economical for banks to make smaller loans and for larger firms to migrate to the commercial paper market. As we will discuss in more detail in the next section, this downward trend in

Chart 1. Output indexes of residential mortgage lending services, first quarter 1991–fourth quarter 2009



SOURCES: U.S. Bureau of Labor Statistics, Federal Housing Finance Agency, Federal Deposit Insurance Corporation, and authors' calculations.

the average size of C&I loans has important implications for the measured growth of lending services associated with these loans.

By comparison, the counts-based approach, in principle, gives an accurate measure of bank lending activities for all loan categories, regardless of the nature of the assets, goods, or services being financed. In practice, however, the accuracy of the output measure depends crucially on having sufficiently detailed data on the number of distinct categories of loans and deposit transactions, along with their respective implicit revenue. In the next two sections, we illustrate how to implement the counts-based measure of bank output empirically with data on commercial and industrial loans and deposit transactions. We will highlight the challenges associated with accounting for different types of loans and deposit transactions and how to assign them proper weights in an overall output index.

Commercial & industrial loans

The Federal Reserve's Survey of Terms of Business Lending is the most extensive source of data on C&I loans.[9] Every quarter, this survey collects information on new C&I loans granted by commercial banks during the sample week. The most important variables for output measurement are the interest rates paid on the new loans, as well as total volume and average size of the new loans, all reported by risk class and interest-rate-reset (i.e., repricing) frequency. Information about these variables allows us to examine whether accounting for detailed loan characteristics matters for the estimated time series of C&I lending services. We can also assess again how output indexes based on activity counts compare with the output index based on CPI-deflated balances.

We first compare two series of C&I output on the basis of the number of C&I loans. In the first series, we assume that C&I loans of different risk classes and repricing frequencies are associated with different amounts of services, and an overall output index is calculated as a Törnqvist aggregate over the number of loans of each type, weighted by their implicit revenue shares. In the second series, we assume that every C&I loan requires the same amount of services, and so we can calculate the aggregate output index as the simple sum of the number of all loans. Denoting N_{it} as the number of loans outstanding[10] of type i in period t, we can represent the respective growth rate ($\Delta\ln$) of these two output series as follows:

$$\Delta \ln N_t^1 = \sum_i \overline{w}_{it} \Delta \ln N_{it}, \text{ and} \qquad (1)$$

$$\Delta \ln N_t^2 = \Delta \ln \sum_i N_{it}, \qquad (2)$$

where w_{it} is the share of type-i loans in the total implicit revenue of C&I lending services; $w_{it} = Y_{it} \Big/ \sum Y_{it}$, and the upper bar denotes that we use a two-period average weight. Note that $\Delta \ln N_t^2$ in equation (2) can be equivalently expressed as a weighted average of $\Delta\ln N_{it}$ with the weights being the share of type-i loans in the total *number* of C&I loans, instead of the share of revenue w_{it} as in equation (1). Series N_t^2 corresponds to the approach taken by BLS in its commercial bank output index. C&I loans in the STBL are split into four different risk categories and five repricing categories, which means we have i=1, . . . , 20 C&I loan types.

As briefly introduced in the previous section, implicit revenue is derived as the margin between the loan interest rate actually charged and the interest rate on market securities with the most comparable risk characteristics but no services attached:

$$Y_{it} = \left(r_{it} - r_{it}^M\right) L_{it} = \left(r_{it} - r_{it}^M\right) s_{it} N_{it}. \qquad (3)$$

The variable r_{it} is the interest rate charged by the bank on a C&I loan of type i in period t, r_{it}^M is the corresponding market interest rate, L_{it} is the C&I loan balance,[11] and s_{it} is the average size of type-i C&I loans in period t. This method is consistent with profit-maximizing behavior of banks, where banks set loan interest rates given the required rates of return on risky investments. This is also known as the *user cost* approach.[12] The choice of the market reference rate r_{it}^M is still subject to debate. One opinion is that r_{it}^M should be the interest rate on a risk-free investment, while the other holds that, in a world with uncertainty, r_{it}^M should be the rate on an investment of comparable risk.[13] For the current purpose of measuring the real value of bank output, this debate is of secondary importance in practice. As long as there is variation in the service interest rate margin $\left(r_{it} - r_{it}^M\right)$ and the average loan size s_{it} across different categories, the output series in equations (1) and (2) can differ.

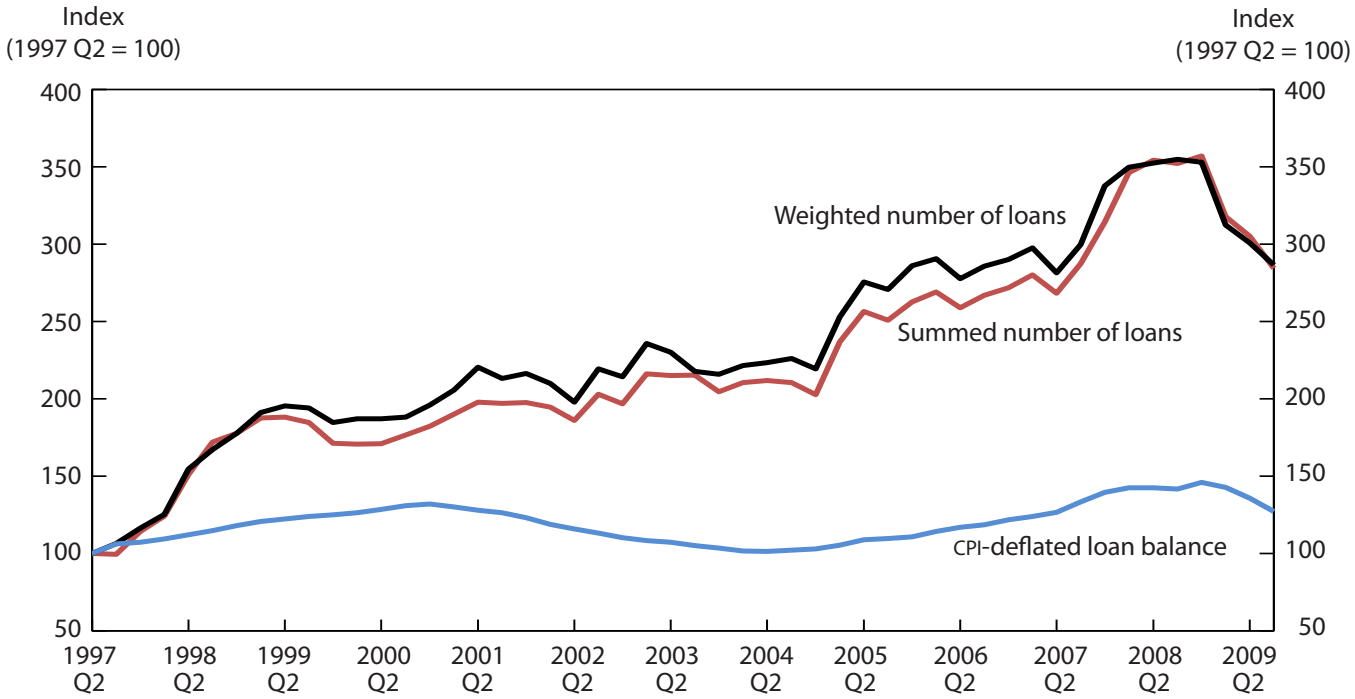
The approach we take in this article is to match each C&I loan type to a class of market security of comparable risk and frequency of interest-rate resets. For C&I loans whose interest rates are reset within a year, we use non-financial firms' commercial paper (CP) rates. We follow the STBL instructions when mapping the risk classes: "minimal" risk loans are for borrowers with a AA or higher rating on their public debt while "low" risk loans are for borrowers with a BBB or higher rating. We therefore use the yields

on non-financial CP rated A1/P1—A1 is the highest short-term rating category assigned by Standard & Poor's, and P1 is the highest such category assigned by Moody's Investors Service—and A2/P2-rated non-financial CP as the reference rates for minimal-risk and low-risk loans, respectively. For the C&I loans with repricing intervals above 1 year, we use the yields on corporate bond indexes with the most similar rating classes, as compiled by Merrill-Lynch.[14] For the risk classes "moderate" and "other," there are no market securities that are clearly comparable, so we assume that the higher interest rates on these loans are due to a larger amount of services as compared to the "low"-risk loans. Alternatively, we could assume that the rate differential is compensation for greater risk. That would reduce the variation in the service interest margin across loan types, making it less likely that we will find differences between the two output series in equations (1) and (2).

Chart 2 plots the two series for the period from the second quarter of 1997 to the third quarter of 2009.[15] The series labeled "summed number of loans" corresponds to $\Delta \ln N_t^2$ in equation (2), while the series "weighted number of loans" is $\Delta \ln N_t^1$ in equation (1). As the chart shows, the series $\Delta \ln N_t^1$ grew faster than $\Delta \ln N_t^2$ for 2 years prior to the 2001 recession and maintained the resulting level gap until late 2007, just prior to this last recession, during which the gap was closed. Consequently, there is little difference between the two series in terms of sample-period trend growth. Over the entire period, the difference in the average annual growth rate between the two series is only 0.1 percentage point: 8.8 for $\Delta \ln N_t^1$ versus 8.7 percent for $\Delta \ln N_t^2$.

This belies notable variations in the underlying interest spreads, average loan sizes, and number of loans across different risk classes and repricing frequencies. Averaged over the sample period, the mean service interest rate margin (i.e., $\left(r_{it} - r_{it}^M\right)$ in equation (3)) varies between 1.18 and 2.55 percentage points across risk and repricing categories, while the average loan size varies between $174,000 and $3 million, and the loan number varies between just below 6,000 and just over 633,000. Note that the dispersion in loan numbers is an order of magnitude greater than the dispersion in interest rates or loan sizes. Moreover, the categories with larger average loan sizes tend to have smaller interest margins and so cross-category dispersion in implicit revenue is dominated by the dispersion in loan numbers, as can be seen from equation

Chart 2. Output indexes of commercial and industrial lending services, second quarter 1997–third quarter 2009



SOURCES: U.S. Bureau of Labor Statistics, Federal Reserve Survey of Terms of Business Lending, Federal Reserve commercial paper rates, Bank of America Merrill Lynch Global Index System through Thomson Reuters Datastream, Federal Deposit Insurance Corporation, and authors' calculations.

(3). It is thus little surprise that the share of each category in implicit revenue is very close to the share in total loan numbers (with a correlation of 0.93). Consequently, the revenue-weighted series exhibits a similar sample growth trend as the simple sum series, which is equivalent to being weighted by loan numbers.

In short, the similar time trend between the two loan-number-based aggregate output series seems more an empirical feature of the STBL data during this particular sample period, and there is no compelling theoretical basis to believe that this similarity will continue indefinitely. In fact, if we instead used a risk-free reference rate r_{it}^{M} for all loan types, as in the proposed new BLS output index, the resulting series would exhibit an average annual growth of 10.1 percent (compared with 8.7 percent for the summed number of loans). Therefore, we think it preferable to utilize available detailed loan information across different risk and maturity categories and compute revenue-weighted aggregate output.

In a more striking contrast, chart 2 also shows an output index based on the outstanding balance of C&I loans deflated by the CPI. While the output indexes based on the number of loans grow by an average annual rate of more than 8.5 percent, the CPI-deflated balance grows by a mere 2 percent on average per year. This reflects the large decline in the average size of C&I loans over this period.

Deposit transactions

This section compares aggregate output indexes of depositor services that are based on transaction counts with the index that is based on CPI-deflated deposit balances. There is a wide range of transaction services at the disposal of the typical holder of a transaction account at a commercial bank: ATM deposits and withdrawals, credit transfers, payments via debit and credit card, checks, etc. This multitude of services presents a challenge in terms of finding each the right weight in an aggregate depositor services output index. The approach that could be used for C&I loans is not feasible for depositor services: there are no adequate data for estimating the (implicit) revenue associated with any of the individual services. Instead, we only have data on the number and dollar volume of transactions.[16]

So we construct an aggregate index of depositor transactions that is based on one of two different assumptions for the aggregation weights. First, we weight every type of transaction equally, which amounts to assuming that customers are willing to pay the same (implicit) fee for each type. This is the weighting scheme currently used by BLS. When the number of type-i transactions in year t is denoted as D_{it}, then the growth rate ($\Delta\ln$) of the aggregate index is calculated as follows:

$$\Delta \ln D_t^1 = \Delta \ln \sum_i D_{it} \tag{4}$$

As an alternative, we assume that customers' willingness to pay for the services embedded in each transaction is proportional to the dollar amount transacted. Under this assumption, we would weight the growth rate of the number of each type of transaction by its share of total transaction value.[17] When the value of type-i transactions in year t is denoted as T_{it}, then the growth rate of this alternative aggregate transaction index is as follows:

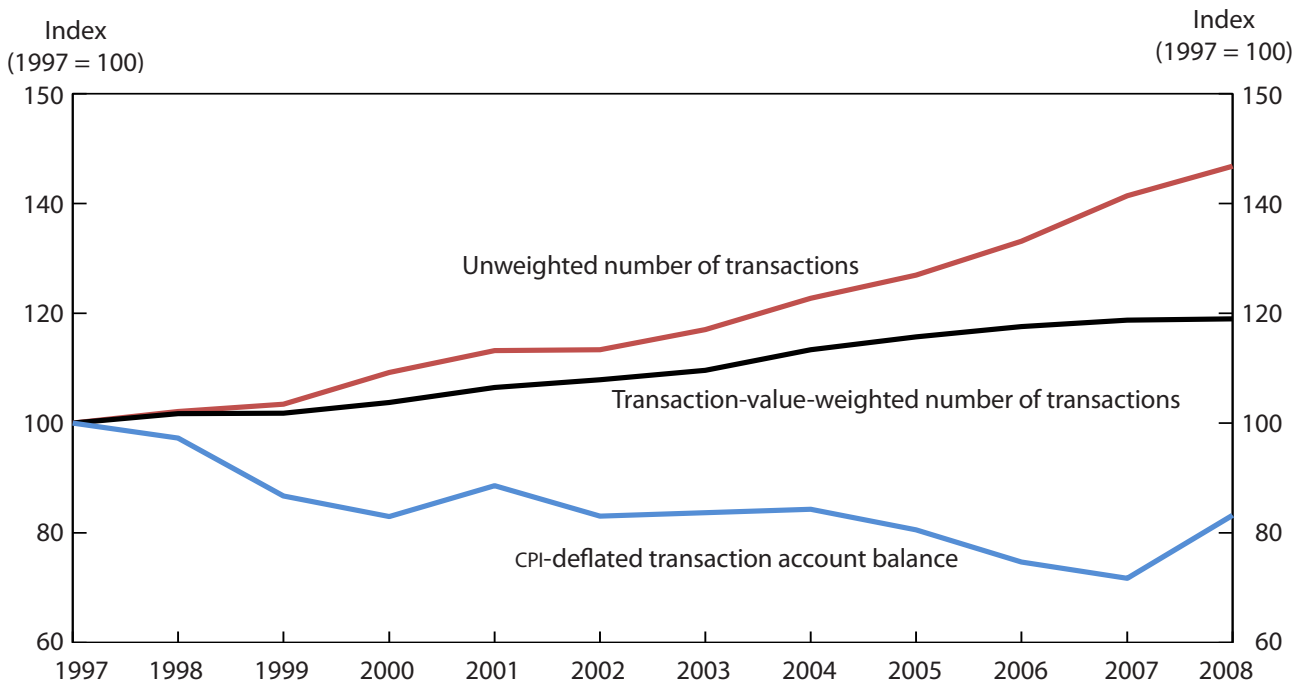
$$\Delta \ln D_t^2 = \sum_i \overline{v}_{it} \Delta \ln D_{it}\,, \tag{5}$$

where $\overline{v}_{it} = 0.5\left(v_{it} + v_{it-1}\right)$ and $v_{it} = T_{it} \Big/ \sum_i T_{it}$.

Chart 3 shows the two output indexes defined in equations (4) and (5), as well as an index based on the CPI-deflated transaction account balance. There is a major divergence between the two transaction-count-based indexes and the balance-based index, with the former showing growth and the latter showing a decline between 1997 and 2008. At the same time, it also matters whether one uses the unweighted sum of transaction counts or the transaction-value-weighted counts: the unweighted sum of counts averages an annual growth of 3.3 percent while the transaction-value-weighted number of transactions averages 1.3 percent. This is because the rapidly growing number of card payments, with an average transaction value of $60, get a much smaller weight than the declining number of check payments, which have an average transaction value of $1,100.

It is necessary to emphasize that both indexes above are approximations, and we cannot be sure whether either index represents an upper or a lower bound of the true output index. This is because we do not know how the true aggregation weights of (implicit) revenue by transaction category compare with our two weighting assumptions above. Short of achieving a first-best solution of (implicit) revenue weight by category (that is, satisfying all but one requirement for achieving the most desirable economic situation), a second-best alternative would be to use data on the processing costs for each type of transaction. But such data are scarce.[18] Some of the (out-of-date) data suggest that the dispersion in the average processing cost is most likely smaller than the dispersion in the average transaction value. This would imply that the unweighted sum is the

Chart 3. Output indexes of depositor services, 1997–2008



SOURCES: U.S. Bureau of Labor Statistics, Bank for International Settlements Red Book, Federal Deposit Insurance Corporation, and authors' calculations.

better approximation between the two series.

Output of nontraditional bank activities

We have so far focused on traditional bank services—making loans and taking deposits. As discussed in the introduction, these services are especially hard to measure because most of them are implicitly priced. As a result, it has not been feasible to survey the prices of the services provided. The alternative is to use the actual number of transactions to measure the quantity of services provided. As we have argued, this measure matches the conceptual definition of financial services better than do deflated balances.

By comparison, it should be less difficult in principle to measure the output of bank services that have explicit fees and commissions. This mode of operation describes a large fraction of the nontraditional bank services, such as underwriting derivatives contracts and cross-selling insurance policies and mutual funds. For these services, it is feasible to survey their prices directly and then apply the standard statistical practice of deriving an (implicit) output quantity index by deflating nominal revenue with an appropriate price index. Conceptually, this output index is equivalent to an index based on appropriately weighted numbers of transactions as constructed for implicitly priced bank services. However, in the case of bank services that generate explicit fees, there is no compelling reason to prefer the measure based on direct counts of transactions unless data of transaction counts are available more readily or cheaply. Therefore, measuring the overall quantity of bank services often entails mixing direct quantity indicators for implicitly priced services and deflated revenue for explicitly priced services. We would argue that this "hybrid" approach is necessary and probably preferable to measuring overall bank output given the available data.

Recommendations for data improvements

There is certainly room for improvement with regard to the availability of data. First of all, to better measure the output of implicitly priced lending services, it would be useful to gather more extensive data on the number, average size, and interest rate of loans distinguished by relevant loan characteristics such as type of borrower, purpose of funding, risk rating, etc. We have illustrated the use of this type of detailed information currently available for

commercial and industrial loans. Similar data should be collected for the larger number of real estate loans, especially commercial real estate loans, as well as for loans provided to consumers for various other purposes.

Second, more information on the costs associated with different types of deposit transactions would also be useful, as costs can serve as the weights for aggregating across a variety of depositor services for which the respective implicit revenue is not available. Such data should cover as comprehensive a range of depositor services as possible: check processing, ATM withdrawals, point-of-sale (POS) transactions, electronic fund transfers, etc.

Improvements to the measurement of explicitly priced services are likewise desirable. For instance, some loans are not held on bank balances but are sold to investors as part of mortgage-backed security pools; the bank charges fees for origination and monitoring services. One approach would be to collect the same type of detailed transaction data as described above for all loans, whether or not they are held on bank balance sheets, and construct a similar transactions-based quantity index associated with servicing fees. The alternative would be to try collecting data on the prices of these servicing fees through price surveys, and deflate the fees with the resulting price index. In addition, there remains a wide range of other services, from treasury services to financial advice, for which no detailed price indexes are available. Given the increasing importance of such nontraditional bank activities in banks' overall income, expanding the scope of price statistics in this area is of great importance.

Our final recommendation involves the measurement of nominal output of implicitly priced services. For the BLS quantity index of bank output, this part of bank nominal output is relevant for providing the weights to aggregate across the different transaction-count-based quantity indexes into an overall bank output index. In the discussion of commercial and industrial loan services, we explained how nominal output is measured for implicitly priced services by netting the risk-adjusted opportunity cost of funds from the interest rate received. As we have argued more extensively in other work,[19] the opportunity cost of funds lent to a borrower who may default, possibly at an interest rate that is fixed for multiple periods, is not the risk-free short-term interest rate. However, such a risk-free rate is currently used by the U.S. Bureau of Economic Analysis, BLS, and many other statistical agencies. This leads to several inconsistencies. For instance, a firm that borrows from a bank will have a lower value of output than an otherwise identical firm that issues bonds. We suggest that statistical practice be revised to use multiple reference rates corresponding to the full range of risky lending (and deposit-taking) by banks. Doing so would reduce the nominal output of implicitly priced services by about 40 percent. The reduction in nominal imputed output would lead to a higher revenue share of nontraditional bank activities, such as securitization and investment banking, except that we would argue that some of the so-called fees from these activities are in fact compensation for the risks embedded in the associated financial instruments, such as bond underwriting. These fees are the capitalized value of purely risk-based payoff, so by the same logic they do not belong in the value of bank services. It will obviously be useful to collect data on the risk attributes of the financial products associated with these fee-generating bank activities.

IN THIS ARTICLE we have argued that the BLS approach to measuring real output of commercial banks is conceptually preferable to the approach taken by many other statistical agencies. Moreover, the BLS approach generates more reasonable empirical estimates. Specifically, BLS uses numbers of loans and deposit transactions to construct its commercial bank output index, whereas most other agencies, including many in Europe, base their bank output indexes on loan and deposit balances, deflated by a general price index such as the CPI.

The literature on the role of banks in the economy has long argued that banks are useful in mitigating information problems by screening loan applicants and monitoring borrowers, and reducing transaction costs by providing payment services. Once we agree that these are the services provided by a bank and thus the object of output measurement, it is more sensible to view each transaction of a given type, rather than each dollar of balance, as representing the same amount of services. This transaction-based method of measuring services then implies that the number of loans underwritten and transactions performed are in principle the right quantity indicators of bank output. Under some limited circumstances, properly deflated balances can give nearly the same result; we show that a house-price deflated balance of residential real estate loans leads to an output index that is fairly similar to the index that is based on the number of those real estate loans. However, it is unlikely that deflated-balances-based indexes provide accurate proxies of bank services. This is evident in the case of an output index of commercial and industrial loans based on the CPI-deflated balance; this index grows considerably slower than an index based on the number of C&I loans. Likewise, the CPI-deflated transaction account balance has declined since the late 1990s, whereas the number of depositor transactions has increased substantially.

Given the diversity of bank services provided to various types of customers, the equally great challenge is how to aggregate across these services, each of which is measured on the basis of the number of that type of transaction. Practically speaking, each type of bank activity almost surely represents a different amount of services, so the activities should be aggregated using their respective revenue weights. This aggregation method follows the standard practice of constructing aggregate indexes of disparate types of service output. As an example, we show that commercial and industrial loans of different risk classes and repricing periods indeed generate different implicit revenue. Aggregation presents a greater challenge in the case of deposit account transactions because we lack data to construct the necessary revenue weights or the cost weights as an alternative.

In summary, we would argue that the count-based approach taken by BLS in constructing its commercial bank output index produces a more accurate measure of the intermediation and transaction services actually performed by banks than the deflated-balances-based approach used by other statistical agencies. Nevertheless, there remains room for improvements. In particular, it is important to gather more detailed information on the number and characteristics—including the exposure to risks—of each category of loans granted, the costs of different types of deposit transactions, the prices of various nontraditional bank activities, and how much of the charges are due to risk. □

Notes

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[1] See, for example, Eurostat, *Handbook on Price and Volume Measures in National Accounts* (Luxembourg: Office for Official Publications of the European Communities, 2001).

[2] See Horst Brand and John Duke, "Productivity in commercial banking: computers spur the advance," *Monthly Labor Review*, December 1982, pp. 19–27, and Sara E. Royster, "Improved measures of commercial banking output and productivity," *Monthly Labor Review*, this issue, pp. 3–17.

[3] See, for example, *Handbook of Price and Volume Measures* for a discussion. The most commonly used broad gauge of inflation is the Consumer Price Index.

[4] The arguments and results in this paper are largely based on Robert Inklaar and J. Christina Wang, "Real Output of Bank Services: What Counts Is What Banks Do, Not What They Own," *Economica,* forthcoming issue.

[5] See J. Christina Wang, Susanto Basu and John G. Fernald, "A General-Equilibrium Asset-Pricing Approach to the Measurement of Nominal and Real Bank Output," in W. Erwin Diewert, John Greenlees and Charles M. Hulten, eds., *Price Index Concepts and Measurement,* Studies in Income and Wealth, 70 (Chicago: University of Chicago Press, 2009), pp. 273–328, for more references as well as a general equilibrium model that shows what this theoretical formulation implies about the measurement of bank output. For a broad discussion of financial functions, see, for example, Ross Levine, "Finance and Growth: Theory and Evidence," in Philippe Aghion and Steven N. Durlauf, eds., *Handbook of Economic Growth* (Elsevier, 2005), pp. 865–934.

[6] See, for example, W. Erwin Diewert, Dennis Fixler and Kim Zieschang, "The Measurement of Banking Services in the System of National Accounts," in W. Erwin Diewert, Dennis Fixler, Kevin J. Fox and Alice O. Nakamura, eds., *Price and Productivity Measurement: Volume 3 – Services*, (Trafford Press, forthcoming) and freely available from **http://www.indexmeasures.com**, for an exposition of sectoral flows in the national accounts system under different bank output measures.

[7] For more details on the user-cost approach, controlling for the risk differences across financial products, see Susanto Basu, Robert Inklaar, and J. Christina Wang, "The Value of Risk: Measuring the Service Income of U.S. Commercial Banks," *Economic Inquiry*, January 2011, pp. 226–245. See Dennis Fixler, Marshall B. Reinsdorf, and George M. Smith, "Measuring the Services of Commercial Banks in the NIPA: Changes in Concepts and Methods," *Survey of Current Business*, September 2003, pp. 33–44, for the approach currently taken in the U.S. national income and product accounts.

[8] One could argue that a larger mortgage requires a greater degree of scrutiny by the bank and hence a larger quantity of services. In practice, however, what banks care about is the loan size relative to the underlying asset's value, which remains the same in this case. Besides, this finer distinction can in principle be handled with data on more detailed loan types.

[9] See the results of the Board of Governors of the Federal Reserve Board's "Survey of Terms of Business Lending" at **http://www.federalreserve.gov/releases/e2/Current/default.htm**. BLS also uses this data source for the estimation of commercial bank output; see Royster, "Improved measures of commercial banking output."

[10] Banks provide screening services during the origination phase to establish a borrower's creditworthiness. After the loan has been originated, banks provide monitoring services until the loan matures. As we have no data for estimating the implicit revenue for screening and for monitoring services separately, we assume that, regardless of the mix between the two types of services for each loan, banks' implicit revenue in each period is calculated according to equation (3).

[11] Note that we scale up the C&I loan balances reported in the STBL to the industry level using the share of the STBL respondent banks in total C&I loan balance, as reported by the FDIC from regulatory financial statements. See Inklaar and Wang, "Real Output of Bank Services," for more details.

[12] See William A. Barnett, "The User Cost of Money," *Economic Letters*, 1978, issue 2, pp. 145–149, for an early contribution.

[13] See Diewert, Fixler, and Zieschang, "The Measurement of Banking Services;" Basu, Inklaar, and Wang, "The Value of Risk;" and Antonio Colangelo and Robert Inklaar, "Bank Output Measurement in the Euro Area—A Modified Approach," *Review of Income and Wealth*, March 2012, pp. 142–165, for more details on this debate.

[14] Specifically, we use the average of AAA- and AA-rated bonds for

the minimal-risk category of loans and the average of A- and BBB-rated bonds for the low-risk category, in line with the STBL instructions. The maturities of these bonds are between 3 and 5 years. The data are provided through Datastream.

[15] The breakdown by risk and repricing category was introduced only with the second quarter 1997 STBL.

[16] The data are from various issues of the Red Book, a reference work published by the Bank for International Settlements.

[17] Note that the dollar value of a transaction is a flow, not a stock, unlike the (deflated) outstanding balance of the customer's deposit account, which is a snapshot of the amount of funds available for any transaction at a point in time.

[18] See, for instance, Kirstin E. Wells, "Are Checks Overused?" *Federal Reserve Bank of Minneapolis Quarterly Review,* fall 1996, pp. 2–12.

[19] Basu, Inklaar, and Wang, "The Value of Risk;" and Colangelo and Inklaar, "Bank Output Measurement in the Euro Area."